Steve Martel

NORTH AMERICAN Mfg. Co.
4455 E. 71 St.
Cleveland, Ohio 44105

A PRIMER ON NO_x

Handbook Supplement 115
5-71

NITRIC OXIDE (NO) is involved in the photo-oxidation (by sunshine) of hydrocarbons, forming eye-irritating smog. Political pressure results in legal maximums (some ridiculously low) on its emission.

NO_x is a commonly-used collective term for "nitrogen oxides" consisting of NO and nitrogen dioxide (NO_2). The NO_2 does little harm, but the two are usually lumped together because available measuring devices cannot separate them.

"NO" FORMATION is favored at high temperature, particularly above 3000 F and it "remains a pseudo-stable specie even at low temps".[1] Residence time at peak temps can be kept to a minimum by high heat transfer rates and by recirculation of flue gases.

"NO" DECOMPOSITION (back to N_2 and O_2) is fastest at temperature levels a few hundred degrees below those best for NO formation.

AIR supplied for combustion provides the N and O for NO formation. Another way to reduce NO formation beside keeping temperature down is ∴ to reduce the availability of the reactants (air), by using less excess air or even running rich and then burning off the products of the rich combustion by adding air later when the flue gases are at a lower temp. "At low excess air levels (nearer stoichiometric), the flame temp increases, but this factor is outweighed by limiting the available oxygen for NO_x formation. Therefore low excess air firing is a powerful technique for NO_x reduction..."[1]

SOLUTIONS—combustion modifications, flue gas cleaning

"What is desired is a very rapid ignition and combustion of the fuel, accompanied by high rates of heat transfer to minimize flame temperature..." From about 2950 F to 2550 F, the rates of heat transfer should be kept fairly low to allow as much time as possible for the NO previously formed to decompose to N_2 and O_2.[2] We can theorize from this that high temperature processes such as forging and ceramic firing may be in less trouble (because they provide NO decomposition time) than low temperature applications such as boilers and incinerators.

REDUCING FLAME TEMPERATURE reduces NO formation, but using excess air to do so makes the reactants (N_2 and O_2) so much more available that more, not less, NO is formed.

Two-stage combustion (rich 1st stage followed by air addition at a lower temperage zone) is similar to the process involved with long luminous flames. Like all NO_x reducing techniques, this lowers the heat transfer rate and increases the size of equipment needed.

Recirculation or dilution of combustion air with flue gas. One report claimed 15% NO reduction with 15% recirculation, but CO emission may go up. Wide-angle Magna-Flame burners incorporate some natural recirculation.

Water or steam injection to lower peak flame temperature might be easy to accomplish utilizing an oil atomizer when a burner is on straight gas, but efficiency may drop and corrosion increase.

LOW EXCESS AIR is the best hope so far, although it probably will not provide enough NO reduction to satisfy all government requirements. Despite the higher flame temperatures, one report showed a 60% drop in NO_x when excess air was cut from 15 to 3%.

CHEMICAL NEUTRALIZATION has not been found economically feasible to date. There is some hope that methods for SO_3 treatment may help reduce NO_x.

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[1] From "Systems Study of Nitrogen Oxide Control Methods for Stationary Sources—Vol. II" (543 pages) by Bartok, Crawford, Cunningham, Hall, Manny, and Skopp of the Esso Research & Engineering Company's Government Research Lab with cooperation and guidance from electric utility and petroleum companies plus Babcock & Wilcox, Foster-Wheeler, and Combustion Engineering.

[2] From "Characterized Pollutant Emissions from Flames" presented to the Canadian Gas Assn., by Friedrich, Mitchell, Lee, and Whaley, Sept., 1970.

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Commonwealth Edison Company
Chicago-South Division

7601 SOUTH LAWNDALE AVENUE ★ CHICAGO, ILLINOIS 60652

January 6, 1972

Mr. Steve Martell
U. S. Scrap Company
11507 South Michigan Avenue
Chicago, Illinois 60628

Re: Relocation of Electric Service
at 12300 South King Drive

Dear Mr. Martell:

Enclosed are two copies of the Project Sketch showing the service relocation you requested. The total cost to you is $729.00.

I have also enclosed two copies of the Service Entrance Location Sketch. If this meets your approval please sign and return one copy to me.

When I have received your approval of the relocation and service entrance and payment of the above amount I will authorize the job for final engineering and construction. It will require approximately 30 days from the time of authorization to complete the work.

If you have any further questions feel free to call me at 471.3375.

Very truly yours,

Jeffrey J. Straman

Jeffrey J. Straman
Power Sales Engineer

SERVICE ENTRANCE LOCATION SKETCH

S.E.R. # CS-10129

THIS INFORMATION FOR THE ELECTRICAL CONTRACTOR AND/OR ARCHITECT

FOR U.S. SCRAP CO.
12300 S. KING DR.

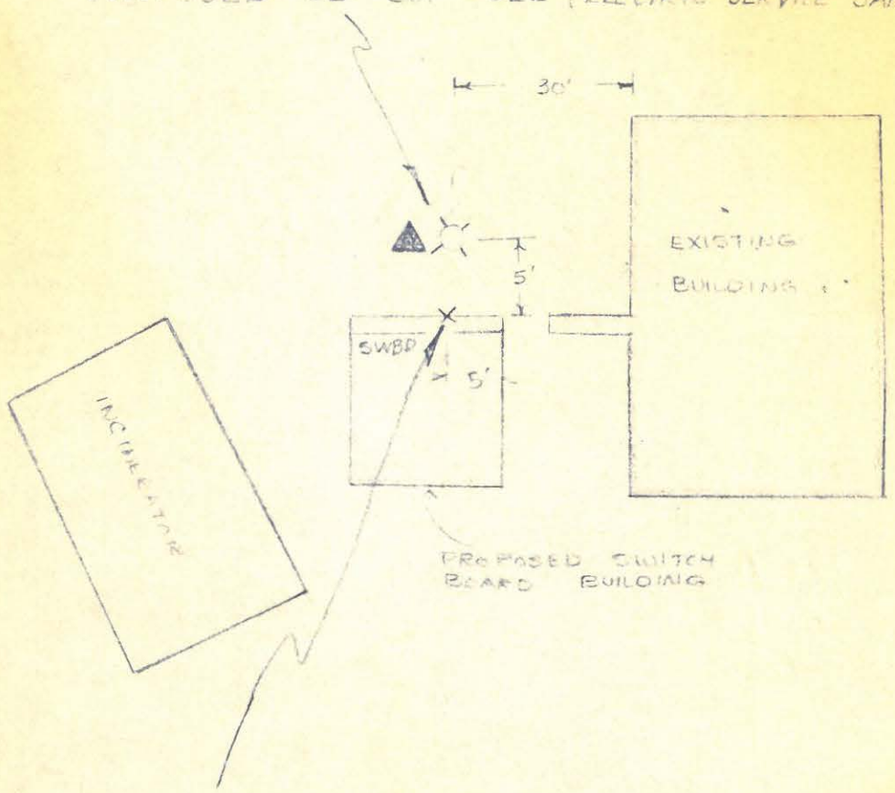
FOR A CONNECTED LOAD OF — K.W. LIGHT, AND 268 H.P. AND — SPECIAL

AND ESTIMATED TOTAL MAXIMUM DEMAND OF 260 KW.

FOR CLASS OF BUSINESS SCRAP YARD SERVICE VOLTAGE 240 VOLT 3Ø

The electrical contractor should secure the approval of the appropriate Municipal Authority and must conform to the Commonwealth Edison Company's Book of Information and Requirements for the supply of Electric Service.
This location is contingent upon there being no objection to crossing adjacent property with service wires if necessary.
Location given is for load shown above, and any change in load may require change in location.
Customer's underground conduit should not be installed in advance of Commonwealth Edison Company's conduit.
Approval of this extension will constitute customer's approval of service location as shown below.

SERVICE TO BE FROM THIS PROPOSED CE. CO. POLE (ELECTRIC SERVICE STATION).



LOCATE 240 VOLT COMBINED LIGHT AND POWER SERVICE ENTRANCE AT THIS POINT 12' ABOVE GRADE.

SERVICE ENTRANCE LOCATED PER CUSTOMER'S REQUEST.

ALL DIMENSIONS ARE ESTIMATES.

Commonwealth Edison Company
DIVISION ENGINEERING DEPARTMENT

BY R. WIDEMAN 12-6-71
ENGINEER DATE

TELEPHONE 471-4856 EXTENSION

86-4061 2-67

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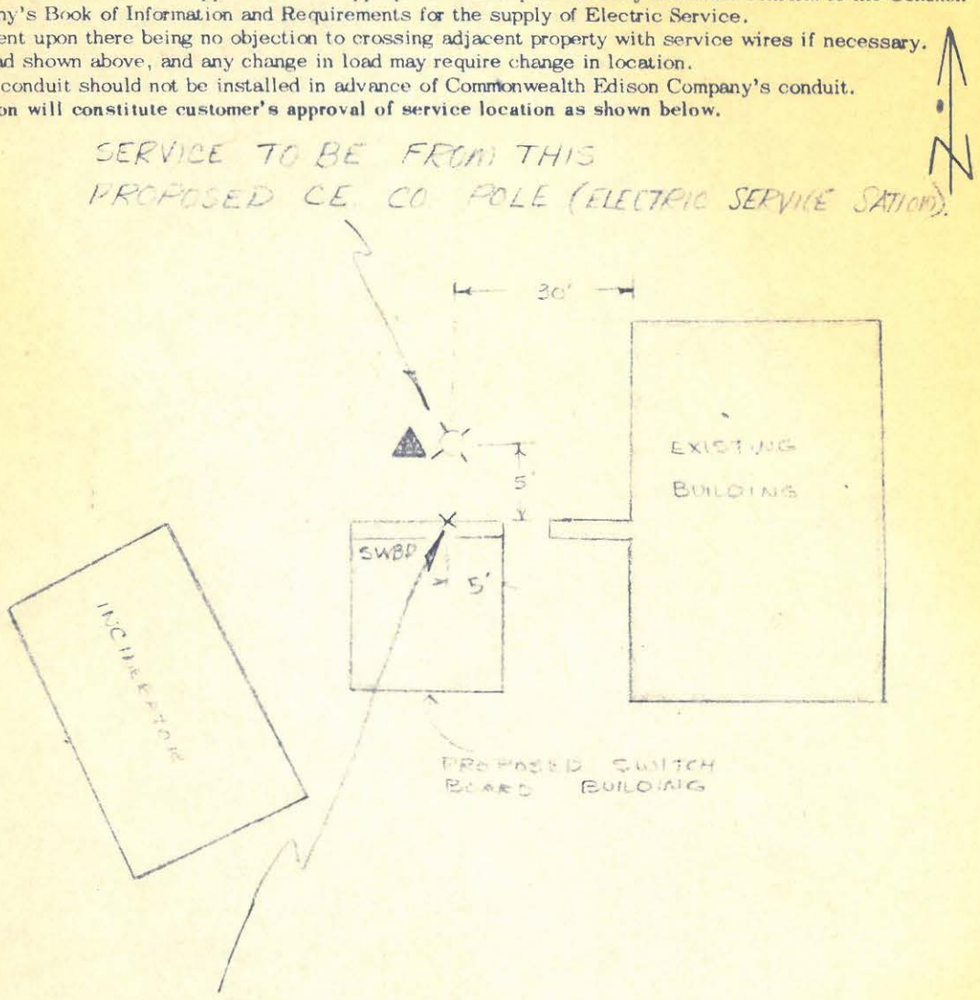

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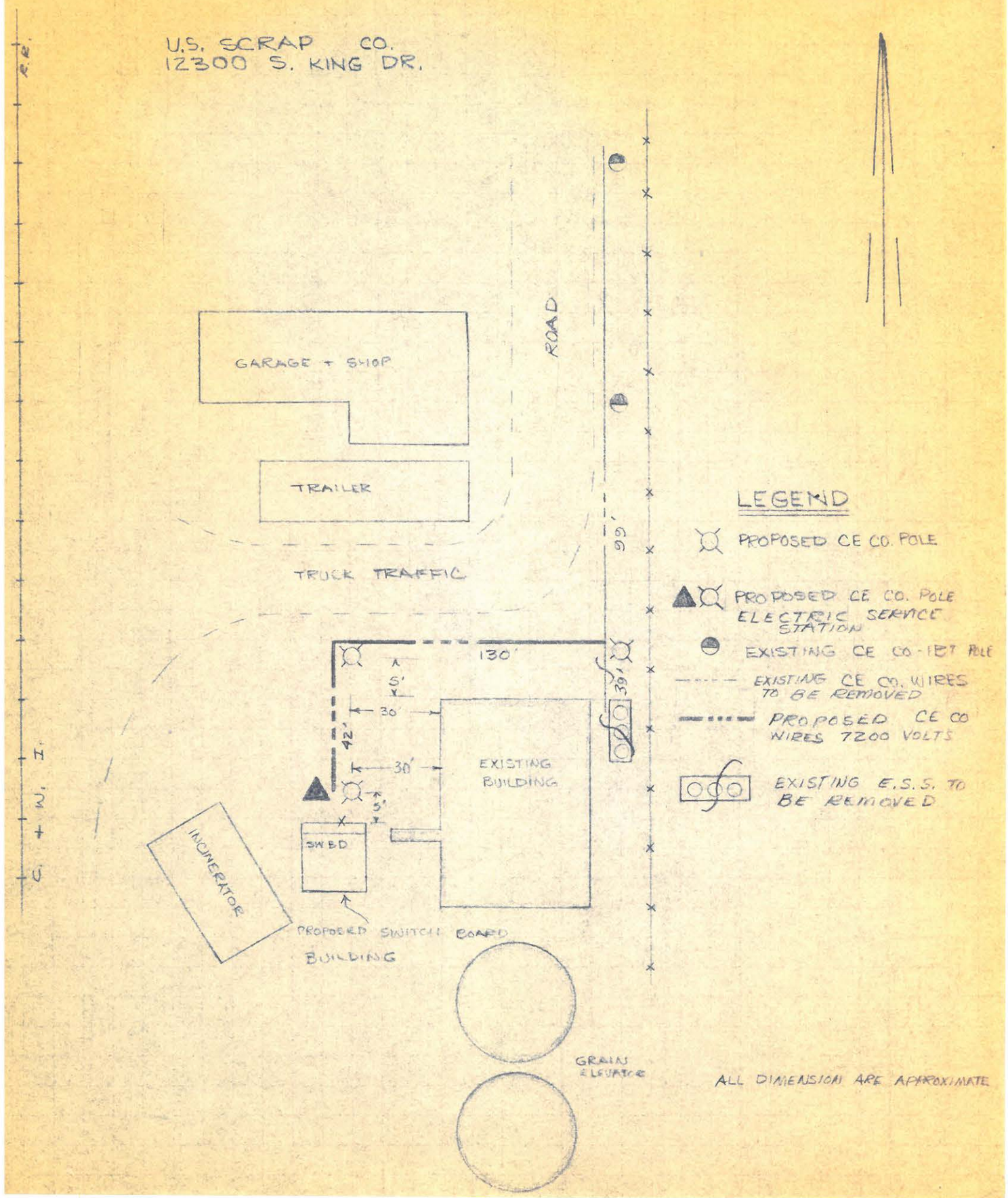

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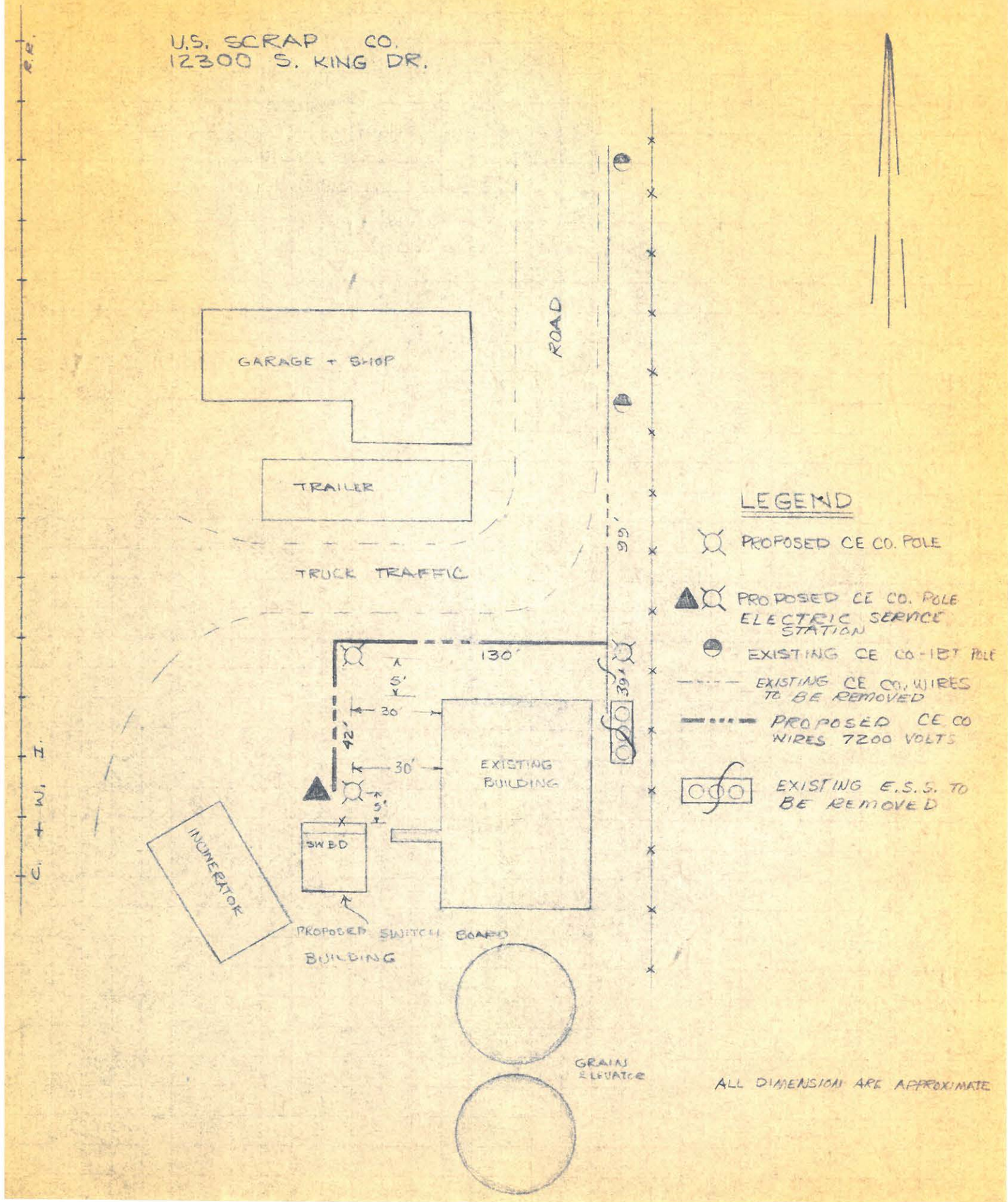
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